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Soil Quality Enhancement Activity - Compaction Avoidance through Controlled Traffic

Compaction Avoidance through Controlled Traffic
Compacted soil restricts root penetration, nutrient cycling, and reduces yield. Compaction restricts water movement into soil, resulting in less water available for plant growth and increased runoff, erosion, and nutrient loss. Within a compacted soil there is less pore space, which is essential for the movement of water, air, nutrients, and soil fauna through the soil. Soil is especially susceptible to compaction when it is wet, low in organic matter, or has poor structure or stability.

Controlled traffic is a method to reduce soil compaction by confining all heavy traffic to specific lanes through crop fields year after year. When planning a controlled traffic system, it is the tractor drive wheels, combine wheels, and any equipment with significant weight on an axle e.g. fertilizer spreader, manure spreader, grain cart, etc., that must be considered. Generally the wheels on planters/drills or tillage tools are not considered heavy traffic. Permanent high-residue cropping systems, otherwise known as conservation tillage systems, work well with controlled traffic systems because previous crop rows are not tilled and traffic rows remain visible. Controlled traffic can be an integral part of ridge-till systems and can work well with no-till systems.

Benefits
Infiltration increases and crop yields normally improve when traffic is restricted to controlled zones between the rows since the soil directly beneath crop rows can retain a loosened structure. Controlled traffic also reduces erosion, runoff and sedimentation as well as the need for sub-soiling. Controlled traffic improves how soil functions to support crop growth and meet production goals.

Criteria for Controlled Traffic Enhancement Activity
Controlled traffic systems must limit wheel/track traffic to no more than 50 percent of the rows or a maximum of 50 percent of the area. There should be no tracks over rows that are 20 inches or wider.

A controlled traffic system has several components:

1. All equipment must cover the same width or multiples of that width (see Figures 1 and 2).
2. The number of traffic lanes should be minimized (see Table 1).
3. If full width tillage is used, GPS is required to maintain the designated traffic lanes.
4. If narrow width or drilled crops are grown, a skip row system or GPS is required.

5. After establishing a controlled traffic system, do not deep till (> 4 inches) the controlled traffic paths.

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Using GPS or other similar guided measurement technology
Mulch tillage systems use full-width tillage across the entire field. For field operations, auto-steer technology using guidance from a Global Positioning System (GPS) is required to locate and use the same traffic lanes year after year. For controlled traffic in a row crop field, an RTK GPS system capable of 1-inch accuracy is recommended. This technology allows controlled traffic with standard agricultural equipment and full-width tillage.

For narrow width row crops (generally 20 inches or less) or crops that are drilled, use skip rows spaced to accommodate the required tire traffic if GPS technology is not available.

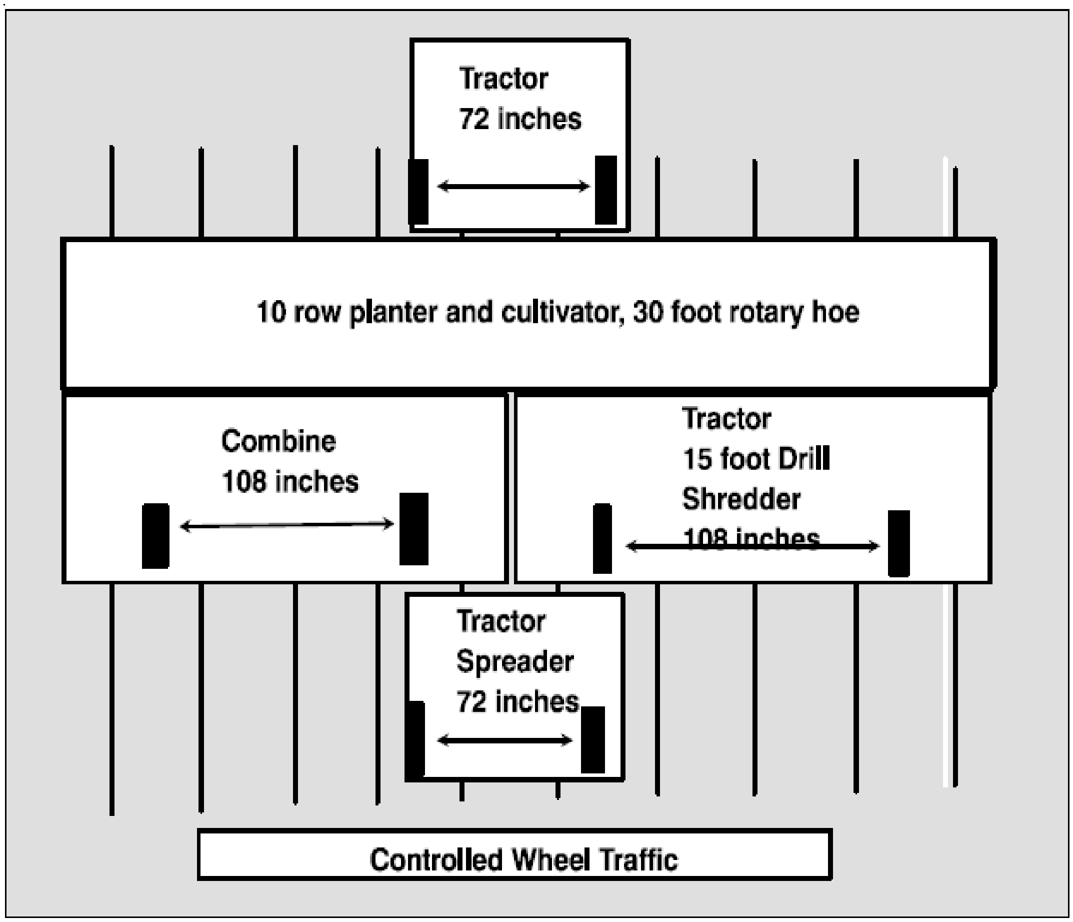

Figure 1. This is an example of a 10 row – 36 inch row planter and equipment that are multiples of the basic width. The combine, drill, and shredder are multiples of the 30 foot planter. All measurements are center of tire to center of tire. Source:www.pfi.iastate.edu/ofr/Thompson_OFR/Chapter_6_Water_Quality.pdf

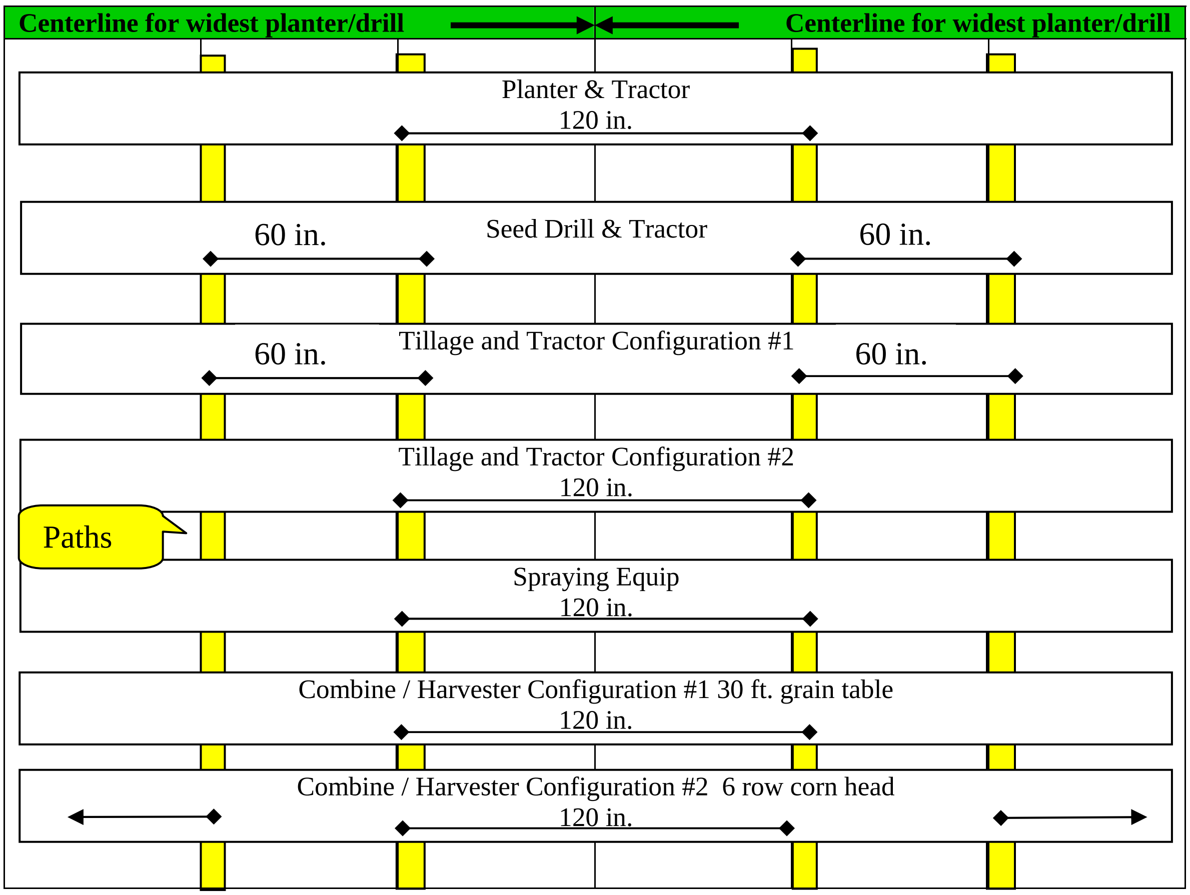

Figure 2. Example of Wheel/Track Spacing and Paths Using Multiples of the Basic Width (units are in inches or number of rows)**:**

<u>Situation:</u> 12 row planter with 30 inch rows for corn, 15 foot grain drill, 6 row corn head on combine, 30 foot grain table on combine, 15 foot tillage tools.

1. If 2 or more tillage operations have the same width and tractor tire configuration the operations are only entered once.
2. If 2 or more combine/harvesting operations have the same width and tire configuration the operation is only entered once.

Note: The 6 row corn head begins by taking the center 6 rows of the 12 row configuration, then harvesting the three outside rows along with 3 outside rows from the adjacent planter pass. This reduces the number of rows receiving wheel traffic. This system results in 33% of the rows receiving wheel or track traffic.

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Table 1. Examples of traffic patterns for controlled traffic systems.

Number of rows	Tractor (in)	Combine (in)	Number of paths	% Trafficked Assumes 20" tires
-----30" row spacing-----				
6	60	120	4	44
6	120	120	2	22
8	120	120	2	17
8	60 & 120	120 & 180	6	50
12	60 & 120	120 (6-row)	4	22
16	60 & 120	120 & 180 (8-row)	8	33
24	60 & 120	120& 180 (12-row)	12	33
-----36" row spacing-----				
6	72	144	4	37
8	72	144	4	28
12	72	144	4	18

Note: All tires are assumed to be 20 inches wide. In the first scenario, the tractor tire spacing is 60 inches and the combine tire spacing is 120 inches. Each set of six rows will have four tire paths and 44 percent of the ground will be trafficked. By increasing the tractor tire spacing to match the combine tire spacing, the number of paths and area trafficked are cut in half.

References

Tullberg, 1998 http://www.uq.edu.au/~gajtullb/control_traffic/index.htm

Wortmann & Jasa, 2003
http://www.ianrpubs.unl.edu/epublic/pages/publicationD.jsp?publicationId=148